PATENT ABSTRACTS OF JAPAN

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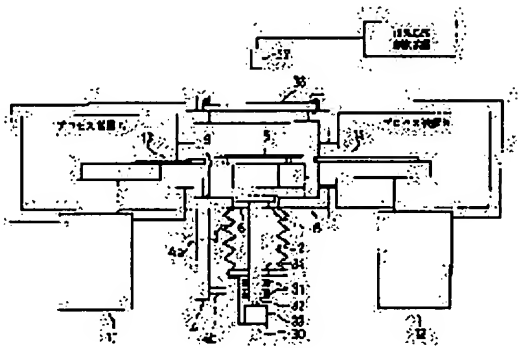
(54) CONVEYING APPARATUS AND CONVEYING METHOD

(57)Abstract:

PURPOSE: To provide a tunnel type conveying apparatus whereby the height and orientation of a wafer can be so modified as to be adapted to the configurations of the delivering means and the wafer processing means of a processor and whereby the transferrings of such objects to be carried as wafers can be performed smoothly in the boundary region between the processor and the tunnel type carrying apparatus without the complicating and large-sizing of the apparatus.



CONSTITUTION: In a tunnel type conveying apparatus, a conveying carriage 9 for mounting a wafer 5 thereon is provided inside a tunnel 7, and the wafer 5 is conveyed in the state wherein the outside air is cut off by a barrier plate 8 to be the crust of the tunnel 7. In this tunnel type carrying apparatus, a platform 1 for putting the wafer 5 thereon, a moving means 4 for moving up and down the platform 1 and a phase modifying means 33 are further provided. By the phase modifying means 33, the circumferential position of an orientation flat provided on the wafer 5 which is in the state wherein the wafer 5 is put on the platform 1 is so modified as to coincide with a predetermined position.

LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] In the transport device which conveys a wafer where the open air is intercepted by the septum which forms the conveyance truck which carries a wafer in the interior of a tunnel, and serves as a coat of the above-mentioned tunnel The table which lays the above-mentioned wafer in the interior of the above-mentioned tunnel, and a migration means to move this table in the vertical direction, The transport device characterized by providing a phase correction means to correct the location of the hoop direction of an orientation flat established in the wafer in the condition of having been laid on the above-mentioned table to the location which was able to be defined beforehand.
[Claim 2] The transport device according to claim 1 characterized by establishing a location correction means to correct to the location which was able to set the center position of said wafer to said migration device beforehand.
[Claim 3] In the transport device which conveys a wafer where the open air is intercepted by the septum which forms the conveyance truck which carries a wafer in the interior of a tunnel, and serves as a coat of the above-mentioned tunnel The table which lays the above-mentioned wafer in the interior of the above-mentioned tunnel, and a migration means to move this table in the vertical direction, A phase detection means to detect the phase shift of the location of the hoop direction where the orientation flat was beforehand defined in the condition of having been laid on the above-mentioned table, and a actual location, The transport device characterized by having the control means corresponding to the above-mentioned phase shift for the above-mentioned table which carries out an include-angle revolution based on the detection result of this location detection means.
[Claim 4] The transport device according to claim 3 characterized by to have a location detection means detect the location gap with the center position of the wafer with which said wafer was beforehand defined in the condition of having been laid on said table, and a actual center position, and the position control means moved to the location which was able to define the above-mentioned table beforehand based on the detection result of this location detection means.
[Claim 5] It is the transport device according to claim 1 to 4 characterized by preparing opening penetrated towards the vertical direction in said conveyance truck, and for said table penetrating the above-mentioned opening, and being constituted free [frequent appearance].
[Claim 6] It is the transport device according to claim 5 which the robot with which the height of the conveyance side which conveys said wafer differs mutually on both sides of said tunnel is stationed, and is characterized by constituting said migration means so that the above-mentioned wafer may be delivered between conveyance sides which are different in above-mentioned each other by making said table project from said opening.
[Claim 7] The transport device according to claim 1 to 6 characterized by preparing the bellows device by which the hermetic seal was carried out to the exterior in opening prepared in the underside or top face of said septum, forming the base material which supports said table in the interior of this bellows device, and preparing the elevator style which makes it go up and down the above-mentioned base material in the exterior of the above-mentioned bellows device.

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[Claim 8] In the conveyance approach of conveying a wafer where the open air is intercepted by the septum which forms the conveyance truck which carries a wafer in the interior of a tunnel, and serves as a coat of the above-mentioned tunnel The phase shift of the location of the hoop direction where the orientation flat was beforehand defined in the condition of having laid the wafer in the table established in the interior of the above-mentioned tunnel possible [rise and fall], and having been laid on the above-mentioned table, and a actual location is detected. The conveyance approach characterized by the thing which corresponded the above-mentioned table to the above-mentioned phase shift based on this detection result, and to do for an include-angle revolution.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to a transport device, is equipped with the conveyance truck which carries a wafer in the interior of a tunnel, and relates to the tunnel transport device which conveys a wafer where the open air is intercepted by the tunnel septum.
[0002]
[Description of the Prior Art] Recently, very advanced cleanliness is demanded about semi-conductor manufacture, and in order to prevent particle contamination, or in order to prevent molecule contamination of oxidation etc., it will be necessary to convey between process units, without putting processed materials, such as a wafer, to the open air. To carry multiple-processes equipment in an epilogue, to carry a wafer in a conveyance truck by the tunnel mold transport device, and to convey the inside of a tunnel as one of such the conveyance approaches, is tried. Drawing 11 shows the example of the semi-conductor production line which combined multiple-processes equipment by the tunnel transport device.
[0003] Drawing 12 is the sectional view which met the A-A line shown in drawing 11 . As shown in this drawing, process units A and B carry out phase opposite, and are arranged at the both sides of the tunnel 7 for conveyance. Robots 11 and 12 are stationed, respectively, and to process units A and B, a wafer 5 is transported to the process chamber 25 of process units A and B, and -- from the conveyance truck 9 which runs in tunnel 7, or the wafer 5 which processing ended with process units A and B conversely is picked out from process units A and B, and is transported to the conveyance truck 9, the conveyance truck 9 runs tunnel 7, and it conveys to the following processor to them.
[0004] With a linear motor, a halt pointing device, etc. which were attached in the septum 8 exterior of tunnel 7 and which are not illustrated, the conveyance truck 9 moves in the inside of tunnel 7, conveys a wafer 5, and stops by the position.
[0005] Moreover, the linear motor type track it can run as a transport device of a tunnel mold, without a conveyance truck contacting the septum of a tunnel inside a tunnel is developed, and according to such a transport device, conveyed objects, such as a wafer, can be conveyed between processors under a very pure environment, without generating a particle in a tunnel. As an example of such a linear motor type track, it is indicated [PCT/JP 93/00930] by this invention person etc. at the detail. It is made to make [the member which has fear of the generation of gas like a magnetometric sensor and an electromagnet is arranged at the atmospheric-air side of the septum of a tunnel, surface the open air and the conveyance truck in the interior of the tunnel where it was intercepted through a thin septum, and] run a conveyance truck with the linear motor similarly arranged to the exterior of the septum of a tunnel or stop with this equipment. Moreover, according to such a linear motor type track, a conveyance truck is able to run in the tunnel which has branching which intersected perpendicularly in the rectangular direction.
[0006]
[Problem(s) to be Solved by the Invention] By the way, in the border area of the above process units and a tunnel transport device, in migration between process unit A which carries out phase opposite of

transporting a wafer 5 to process unit B from process unit A, and B, the robot 11 of process unit A once places a wafer 5 on the conveyance truck 9, next the robot 12 of process unit B takes up the wafer 5 on the conveyance truck 9, and actuation of transporting into process unit B is carried out to it. That is, between process unit A which carried out phase opposite, and B, when delivering a wafer 5, it must stop between process unit A and B in spite of not conveying a wafer 5, having had to use the conveyance truck 9 as a temporary table which delivers a wafer 5. Furthermore, when the conveyance truck 9 was moving to other locations in a tunnel by chance, a wafer 5 could not be delivered, and time amount until the conveyance truck 9 returns between process unit A and B was useless.

[0007] Moreover, as shown in drawing 13 , the method of delivering the direct wafer 5 by the robots 11 and 12 between process unit A and B is also considered. However, as shown at drawing 14 in such a case, the configuration of fingers 13 and 14 must be the configuration in which it does not interfere mutually. However, as the configuration of fingers 13 and 14 was defined corresponding to the configuration of the wafer table (not shown) arranged in the process chamber 25 of process units A and B and was shown in drawing 14 , it was not easy to change so that fingers 13 and 14 may not interfere mutually. For this reason, the method which transports a wafer 5 directly with robots' 11 and 12 fingers 13 and 14 between process unit A and B was not employable.

[0008] Furthermore, there is a difference in the height of the wafer conveyance side of process units A and B and the process units A and B connected as a trouble of the border area during tunnel 7. Since a limitation is located in the range of the vertical movement for some robots for a transfer when the wafer conveyance side of a common process unit is different for every equipment and it is going to connect these to a common tunnel transport device, it may be difficult to deliver and receive a wafer from a conveyance truck.

[0009] Moreover, there are some which a robot cannot move in the vertical direction depending on a process unit. in such a case, the upper and lower sides which have arranged the medium robot chamber 27 between process unit A and tunnel 7, and have been arranged in this medium robot chamber 27 as shown in drawing 15 and drawing 16 -- wafer conveyance side height is adjusted by delivering a wafer 5 via the movable robot 28. However, when such equipment had been arranged further, there was a problem of the transport device of a wafer having been enlarged and becoming comparatively high-priced.

[0010] Furthermore, it is prepared in order that flat notching called an orientation flat (it is hereafter called a cage hula for short) may decide the location of the hoop direction of a wafer to be a wafer. And there is a thing with the need of doubling this cage hula in the predetermined direction depending on a process unit, and passing a robot.

[0011] This invention was made for the purpose of solving the various technical problems mentioned above, and it aims at offering the transport device which can transport a wafer smoothly in the border area of a process unit and a tunnel transport device, without carrying out complication enlargement of the equipment.

[0012]

[Means for Solving the Problem] In the transport device which conveys a wafer where the open air is intercepted by the septum which the transport device of this invention forms the conveyance truck which carries a wafer in the interior of a tunnel, and serves as a coat of a tunnel It is characterized by providing a phase correction means to correct the location of the hoop direction of a cage hula established in the wafer in the table which lays a wafer in the interior of a tunnel, a migration means to move this table in the vertical direction, and the condition of having been laid on the table to the location which was able to be defined beforehand.

[0013]

[Function] If a wafer is laid in a table from a conveyance truck, it will go up and down a table so that it may be in agreement with the height of the conveyance side of the robot with which the height of the conveyance side hands over a wafer. Moreover, a phase correction means corrects the location of a cage hula to the location which was able to be defined beforehand. Therefore, a wafer can be delivered smoothly, actuation of migration means, such as a robot, being easy and simplifying the configuration.

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[0014]
[Example] Hereafter, one example of this invention is explained with reference to drawing 1 thru/or drawing 9 . Drawing 1 shows arrangement with a process unit and a transport device, and drawing 2 is the sectional view which met the A-A line of drawing 1 which shows the configuration between a process unit and a transport device. Moreover, drawing 3 is the sectional view showing the detail of a table. In addition, in the following explanation, a same sign is given to a component equivalent to said conventional example, and the explanation is omitted. As shown in drawing 1 , the table 1 is arranged in the halt location of the location 9 where conveying and delivering a wafer 5 via tunnel 7 is planned, i.e., the conveyance truck between process units A and B. the configuration of the following [table / 1 / this] -- rise and fall -- and it is constituted pivotable.
[0015] As shown in drawing 3 , the elevator style 4 is attached in the underside of the septum 8 of tunnel 7. The outline configuration of the elevator style 4 is carried out from slider 4b driven with the stepping motor which is not illustrated while being supported by linear guide 4a which turned the longitudinal direction in the vertical direction, and linear guide 4a possible [sliding]. The frame 30 by which the interior was made hollow is attached in this slider 4b. The bearing 31 and 31 of the couple mutually estranged in the vertical direction is attached in the interior of a frame 30, and the shaft 2 is supported for the vertical direction by bearing 31, enabling free sliding. The upper bed section of a shaft 2 penetrates the opening 6 formed in the septum 8 of the tunnel 7 bottom, and the table 1 is attached in a projection and its upper bed side in the tunnel 7. On the other hand, the soffit section of a shaft 2 is connected with the revolving shaft of a stepping motor (phase correction means) 33 through coupling 32. In addition, let the table 1 be the magnitude which can pass opening 6.
[0016] The magnetic fluid seal 34 is attached in upper bed opening of a frame 30, and ends opening of the airtight elastic bellows 3 is attached in the periphery of the rim section of the magnetic fluid seal 34, and the opening 6 of a septum 8 at it, respectively. The magnetic fluid seal 34 closed the clearance between shafts 2 airtightly, and bellows 3 has covered airtightly the space between opening 6 and the magnetic fluid seal 34 from the outside. Thereby, the interior of bellows 3 is also maintained at the same vacuum as the inside of tunnel 7. And by driving the elevator style 4, a table 1 is made to project from opening 6 in tunnel 7, when delivering a wafer 5, and when a conveyance truck stops on opening 6 or it passes, it is held into opening 6.
[0017] Next, an aperture 35 is formed in the septum 8 of a tunnel 7 upside, and the aperture 35 is sealed with the transparent glass plate 36. The shape recognition sensor 37 is arranged on the outside of an aperture 35. A sensor 37 recognizes the configuration of a wafer 5 and supplies it to the signal-processing control unit 38 by making the information into a configuration signal. The signal-processing control unit 38 calculates the phase shift of a wafer 5 from a configuration signal, and supplies the control signal of angle of rotation to a stepping motor 33.
[0018] Next, drawing 4 is drawing showing the conveyance truck 9. The opening 10 penetrated in the vertical direction is formed in the conveyance truck 9, and this opening 10 can be passed now through a table 1. A wafer 5 is positioned and laid by two or more pins 21 attached in the top face of the conveyance truck 9. Although a wheel 22 makes it run the conveyance truck 9 in the conveyance direction, it becomes unnecessary in the magnetic devitation system transport device make carry out magnetic levitation of the conveyance truck 9, and it is made to run by the septum 8 and non-contact.
[0019] Next, actuation of the transport device of the above-mentioned configuration is explained. In the state of the beginning, the table 1 has fallen downward and is held in the opening 6 of a septum 8. In this condition, the conveyance truck 9 carries a wafer 5, and it stops on opening 6 (refer to drawing 5). Next, as shown in drawing 6 , a table 1 goes up from opening 6, and it raises to the location which passes the opening 10 of the conveyance truck 9 and shows a wafer 5 to drawing 7 . In this condition, shape recognition of the wafer 5 by the sensor 37 is performed.
[0020] A sensor 37 supplies the image data of the wafer 5 generated with the television camera which is not illustrated to the signal-processing control unit 38. The signal-processing control device 38 compares the image data used as the criteria beforehand remembered to be the image data supplied from the sensor 37. The image data used as criteria is data based on the image the core O0 of a wafer 5 serves

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as a coordinate (x0, y0) predetermined in xy coordinate top on a table 1, and cage hula 5a turns [image] to for example, the direction of a x axis, as a two-dot chain line shows to drawing 9 . Moreover, as a continuous line shows the actual image data on the table 1 of a wafer 37 in drawing 9 , the core O1 of a wafer 5 serves as a coordinate (x1, y1), and cage hula 5a is data based on the image with which only the include angle theta inclined to the x axis. And among the actual image data of a wafer 5, from the coordinate (x1, y1) of a core O1, and the coordinate of the edges P and Q of cage hula 5a, the signal-processing control device 38 calculates the include angle theta which the direction of cage hula 5a makes to a x axis, and supplies this count result to a stepping motor 33 as a control signal of angle of rotation. A stepping motor 33 does the include-angle theta revolution of a shaft 2 based on a control signal. A sensor 37 is always continuing sending the picture signal of a wafer 5 to the signal-processing control unit 38. The signal-processing control device 38 compares image data and criteria image data after a wafer 5 stops, and those differences judge whether it is tolerance. And if it is not tolerance, the control signal of angle of rotation will be supplied to a stepping motor 33, and an above-mentioned process will be repeated. moreover -- if the difference of image data is tolerance -- the height of a table 1 -- predetermined height (height which can transfer a wafer 5 to a robot's 12 finger 14) -- until -- a control signal is supplied to the elevator style 4 so that it may move.

[0021] Next, as shown in drawing 8 , the finger 14 of the robot 12 of process unit B extends to a wafer 5 side, and grasps a wafer 14. Then, a table 1 descends and is settled in opening 6, and the conveyance truck 9 moves it to other locations, in order to convey the following wafer 5. On the other hand, a finger 14 supplies a wafer 5 to the predetermined process chamber 25 in process unit B, and the process chamber 25 processes a wafer 5. In this case, since cage hula 5a of a wafer 5 is already turned in the predetermined direction, moreover, the wafer 5 in the process chamber 25 can be positioned in a high precision by the easy configuration.

[0022] In the transport device of the above-mentioned configuration, since a table 1 can go up and down and the height of a wafer 5 can be doubled, robots' 11 and 12 height, i.e., conveyance side, of fingers 13 and 14 of process units A and B, a wafer can be delivered smoothly, without complicating robots' 11 and 12 configuration. Moreover, since it turns in the direction which the image data of the wafer 5 from a sensor 37 was processed [direction], and had the direction of cage hula 5a set up, the positioning device of the wafer 5 within the process chamber 25 can be simplified.

[0023] Next, other examples of this invention are explained with reference to drawing 10 . The example shown in drawing 10 is what was constituted so that positioning of a wafer 5 might be performed also about the center position of not only the direction of cage hula 5a but the wafer 5, therefore infixes X-Y table 41 between slider 40b of the elevator style 40, and a frame 30, and is made as [stop / in the location of the arbitration of the horizontal predetermined range / a table 1]. In addition, the various things already marketed as an X-Y table can be used.

[0024] In the transport device of the above-mentioned configuration, a sensor 37 supplies the image data of the wafer 5 generated with the television camera to the signal-processing control unit 38 like said example in the condition which shows in drawing 7 . The signal-processing control device 38 compares the image data used as the criteria beforehand remembered to be the image data supplied from the sensor 37. In that case, in drawing 9 , the signal-processing control device 38 performs the comparison with the main coordinate (x0, y0) of not only the phase of cage hula 5a in both image data but criteria, and a actual main coordinate (x1, y1), and calculates x of these coordinates, and the difference of the direction of y. And from the difference of the phase of cage hula 5a, and the difference of x and a y-coordinate, the signal-processing control unit 38 calculates angle of rotation of a wafer 5, and the travel to x and the direction of y, and generates the control signal of angle of rotation, and the control signal of x and y directional movement. These control signals are supplied to a stepping motor 33 and X-Y table 41, respectively. A stepping motor 33 rotates a table 1 based on a control signal, and X-Y table 41 moves a frame 30 in x and the direction of y based on a control signal, and doubles the core of cage hula 5a and a wafer 5 with a criteria location. Furthermore, as compared with criteria image data, those differences judge whether it is tolerance for the picture signal of the wafer 5 after the location correction to which the signal processor 38 was supplied from the sensor 37. And if it is not tolerance, a control signal will

be supplied to a stepping motor 33 and X-Y table 41, and an above-mentioned process will be repeated. Moreover, if the difference of the image data about the direction and center position of cage hula 5a is tolerance, a control signal will be supplied to the elevator style 4 so that the height of a table 1 may move to a conveyance side.

[0025] In the transport device of the above-mentioned configuration, since not only the direction of cage hula 5a of a wafer 5 but a center position can be doubled with a criteria location on a table 1, the positioning process of the wafer 5 in the multiple-processes chamber 25 of process units A and B can be skipped, and the configuration inside process units A and B can be simplified substantially.

[0026] In addition, in the above-mentioned example, in order to double the center position of a wafer 5, X-Y table 41 is used, but it is not limited to such a configuration and the device of the automatic centripetalism chuck of 3 pawls with which an engine lathe is equipped may be applied, and you may constitute so that the side face of a wafer 5 may be pressed from three directions on a table 1.

[0027]

[Effect of the Invention] The table which lays a wafer in the interior of a tunnel according to this invention as explained above, Since a phase correction means to correct the location of the hoop direction of a cage hula established in the wafer in a migration means to move this table in the vertical direction, and the condition of having been laid on the table to the location which was able to be defined beforehand is provided, Are corrected so that the height and sense of a wafer may suit the configuration of the carrier delivery means of a process unit, and a wafer processing means, therefore it sets to the border area of a process unit and a tunnel transport device. Conveyed objects, such as a wafer, can be transported smoothly, without carrying out complication enlargement of the equipment.

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OPERATION

[Function] If a wafer is laid in a table from a conveyance truck, it will go up and down a table so that it may be in agreement with the height of the conveyance side of the robot with which the height of the conveyance side hands over a wafer. Moreover, a phase correction means corrects the location of a cage hula to the location which was able to be defined beforehand. Therefore, a wafer can be delivered smoothly, actuation of migration means, such as a robot, being easy and simplifying the configuration.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view showing the relation of arrangement between the tunnel transport device of each example of this invention, and a process unit.
[Drawing 2] It is the sectional view which met the A-A line in drawing 1 of the transport device of the example of this invention, and is drawing showing the condition that a wafer is transported through a table.
[Drawing 3] It is the sectional view showing the detail of the part of the table in drawing 2 .
[Drawing 4] It is the perspective view showing the detail of a conveyance truck.
[Drawing 5] It is the sectional view which met the A-A line in drawing 1 of the transport device of the example of this invention, and is drawing showing the condition that the conveyance truck has stopped on a table.
[Drawing 6] It is the sectional view which met the A-A line in drawing 1 of the transport device of the example of this invention, and is drawing showing the condition that the table is going up through opening of a conveyance truck.
[Drawing 7] It is drawing showing the condition of the table having gone up further from the condition shown in drawing 6 , and having arrived at the lifting edge.
[Drawing 8] It is drawing showing the condition that a robot's finger grasped the wafer and the table descended from the condition shown in drawing 7 .
[Drawing 9] It is a top view for explaining the correction process of the location of a wafer.
[Drawing 10] It is the sectional view showing the detail of the part of the table in other examples of this invention.
[Drawing 11] It is the top view showing the relation of arrangement between the conventional transport device and a process unit.
[Drawing 12] It is the sectional view which met the A-A line in drawing 11 of the conventional transport device.
[Drawing 13] It is drawing showing the condition of transporting a wafer directly by a robot's finger between the process units of the both sides shown in drawing 12 .
[Drawing 14] It is drawing showing the relation of the robot's finger and wafer in drawing 13 .
[Drawing 15] In drawing 11 , it is the top view showing the condition of having arranged the medium robot chamber between a process unit and a transport device.
[Drawing 16] It is the B-B line sectional view of drawing 15 .
[Description of Notations]
1 Table
2 Shaft
3 Bellows
4 Elevator Style (Migration Means)
5 Wafer
7 Tunnel

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8 Septum
9 Conveyance Truck
30 Frame
31 Bearing
33 Stepping motor (phase correction means).
34 Magnetic Fluid Seal
35 Aperture
37 Shape Recognition Sensor
38 Signal-Processing Control Unit

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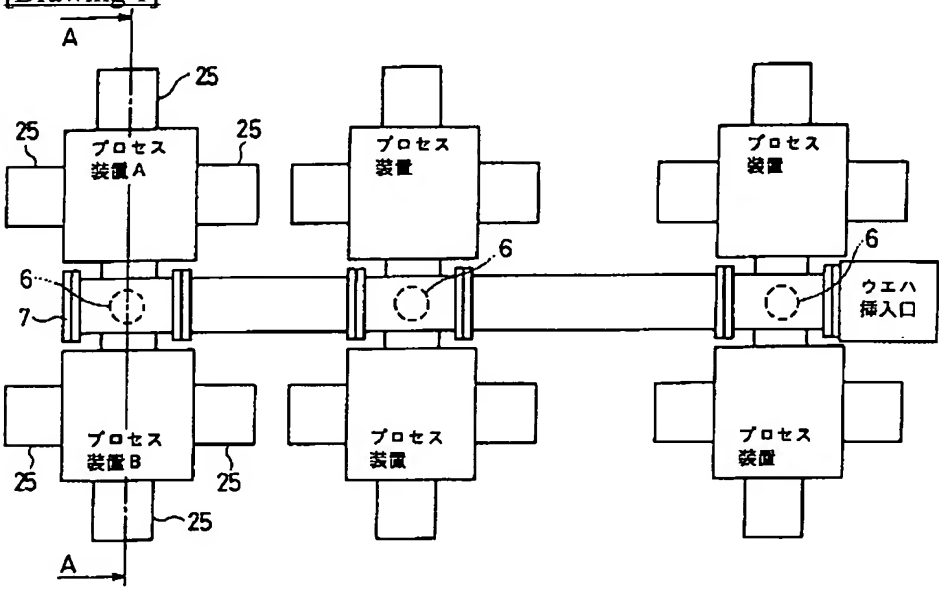
DRAWINGS

[Drawing 1]



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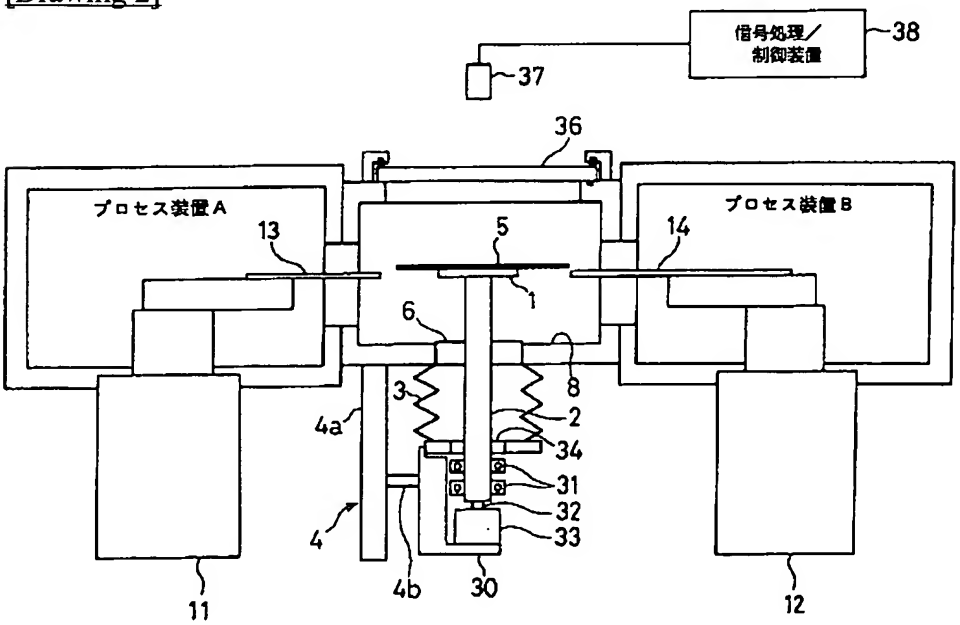

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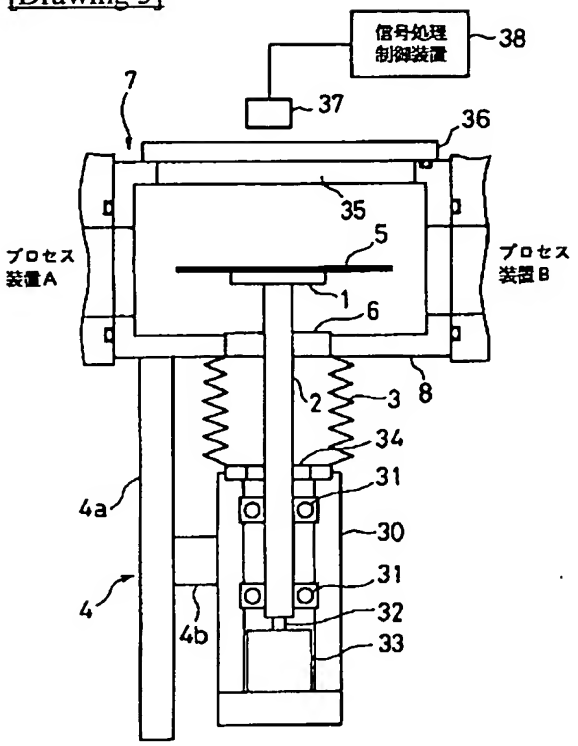
[Drawing 3]



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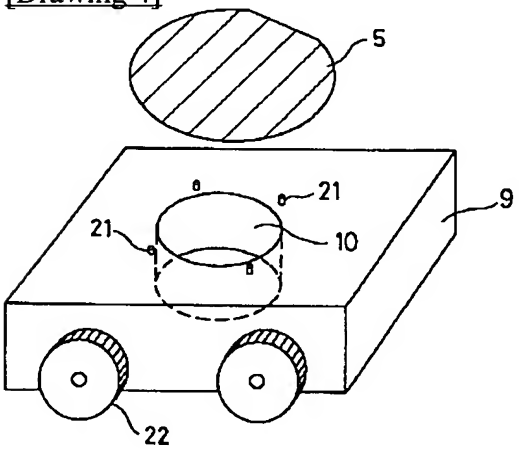

[Drawing 5]

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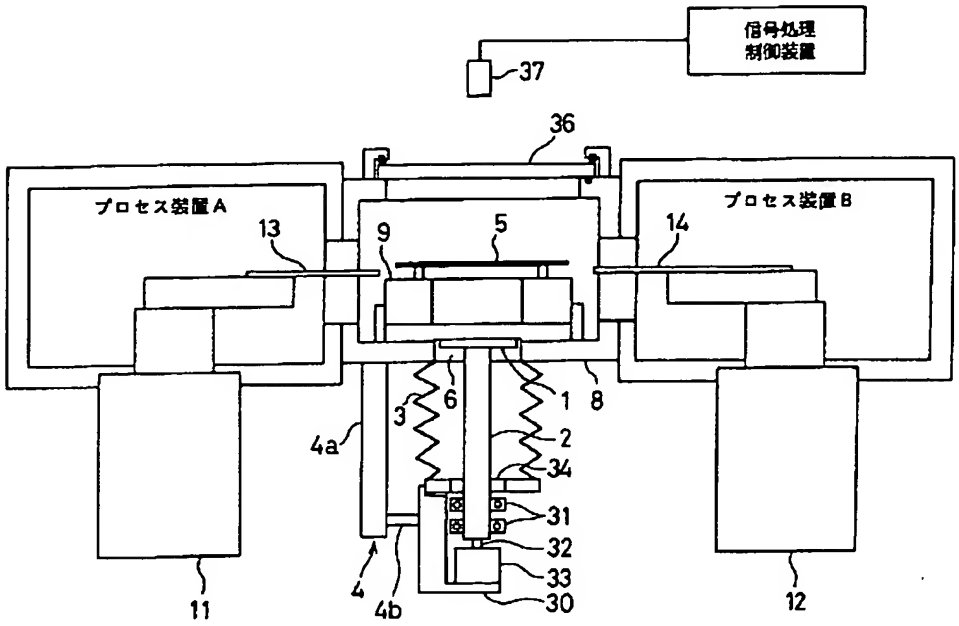

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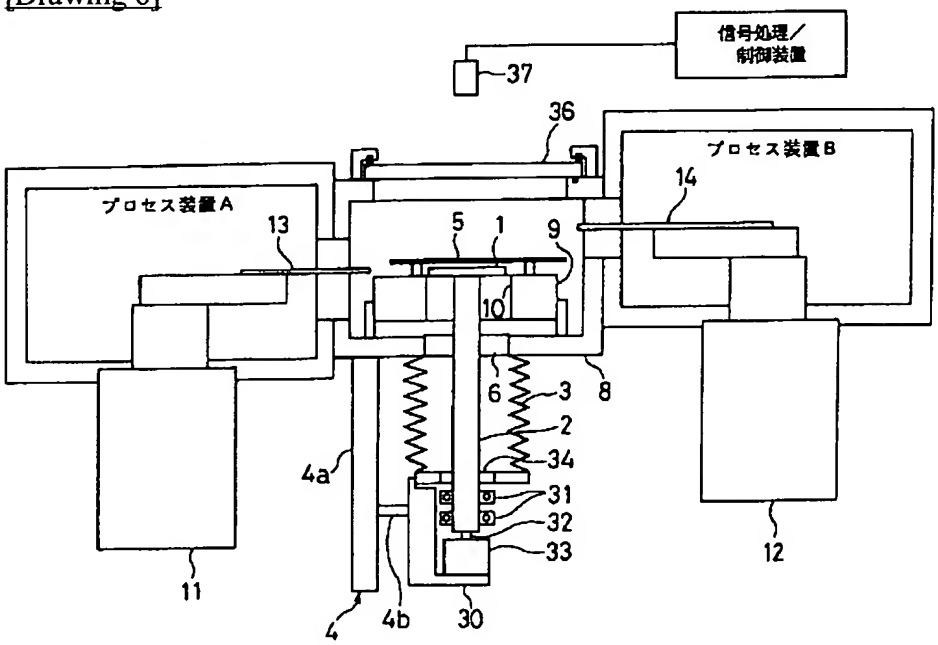

[Drawing 7]

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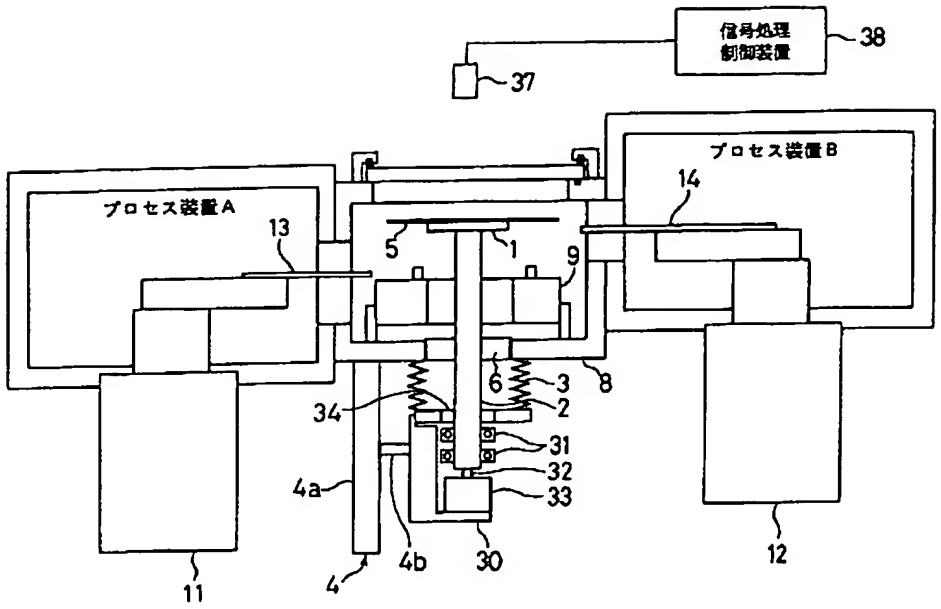
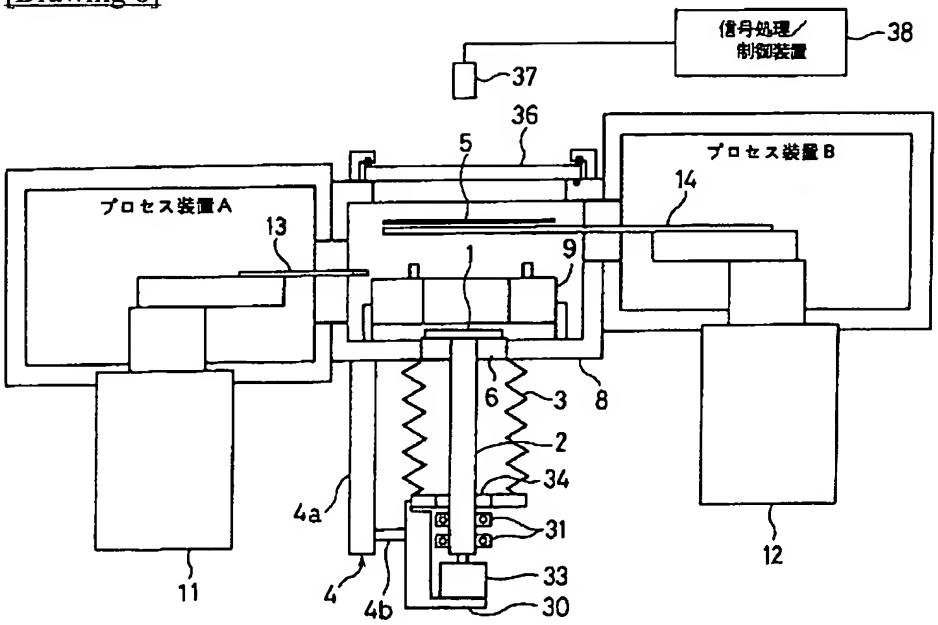
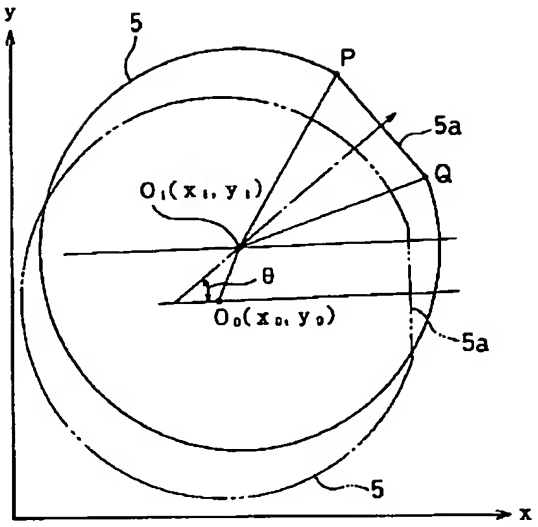


[Drawing 8]

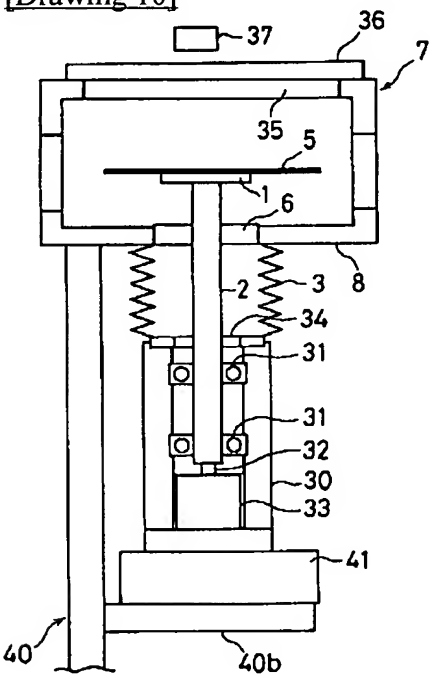


[Drawing 9]

h g cg b eb cg e e

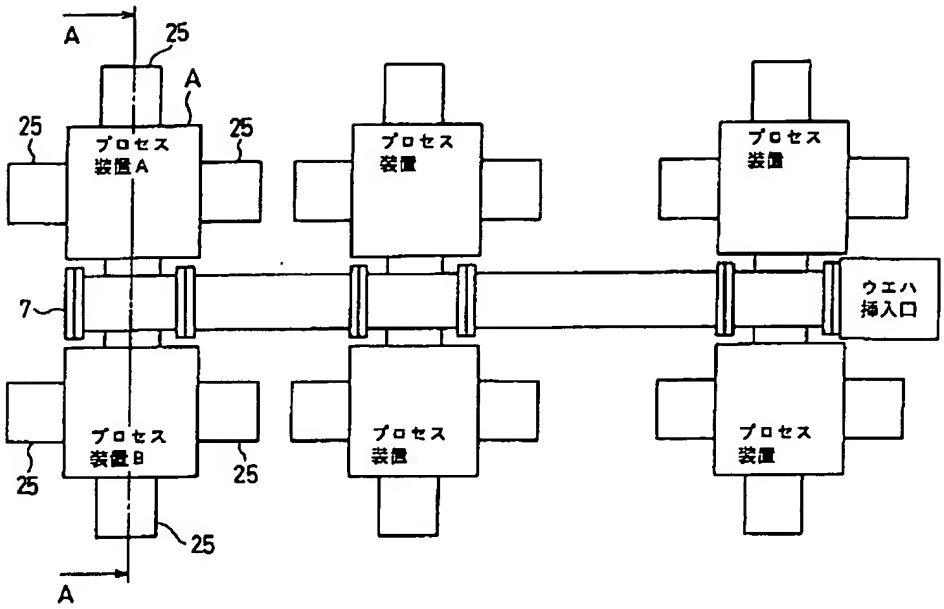


[Drawing 10]

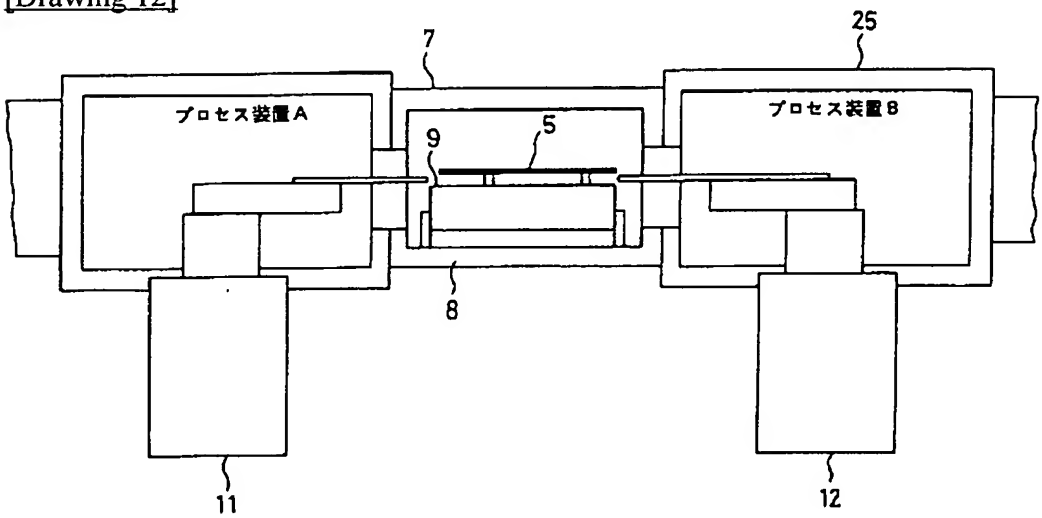


[Drawing 11]

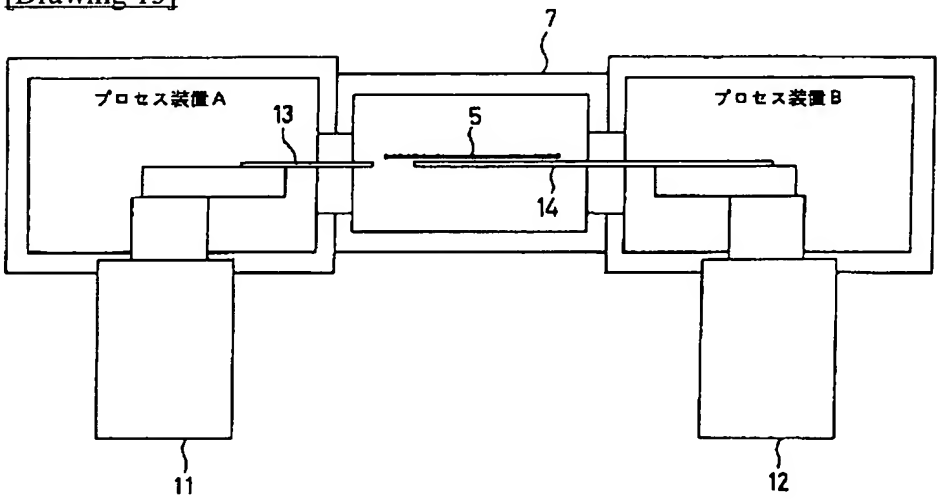
h g cg b eb cg e e



[Drawing 12]

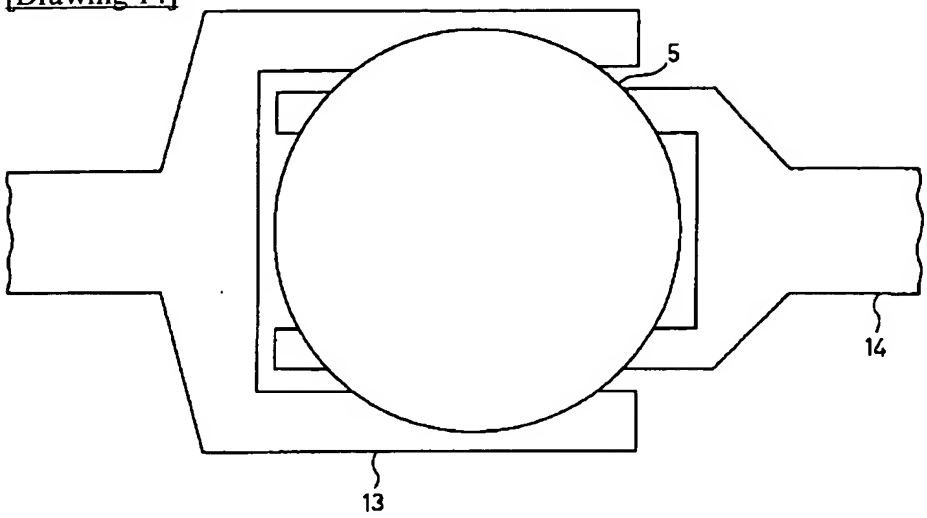


[Drawing 13]

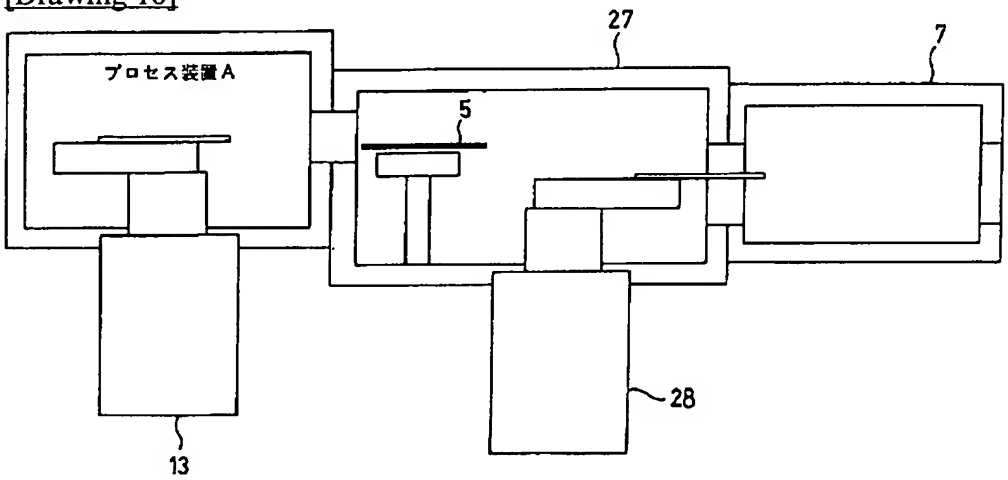


h g cg b eb cg e e

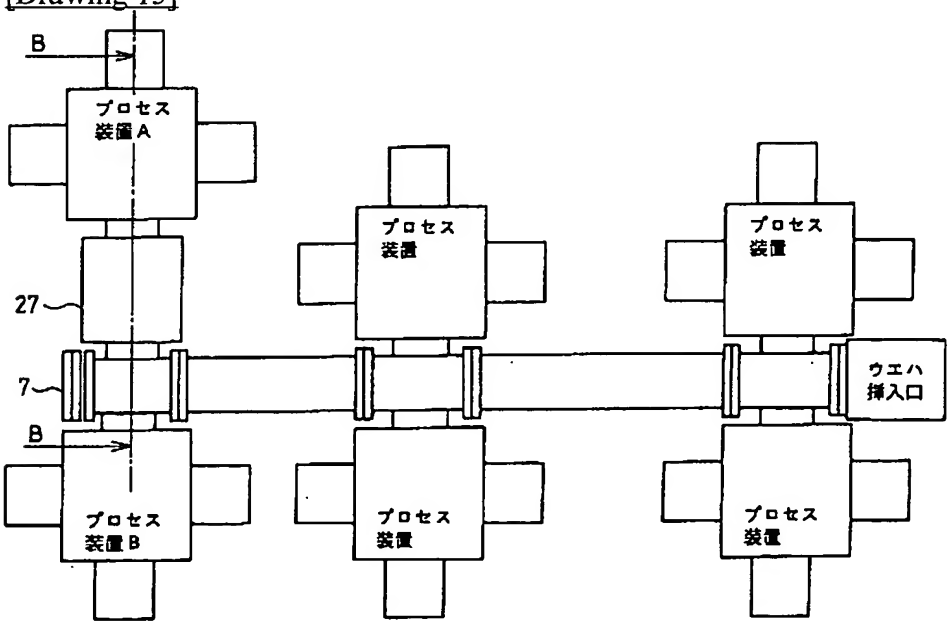
[Drawing 14]



[Drawing 16]



[Drawing 15]



h g cg b eb cg e e